A Marshall Cavendish Collection

EVERY FORTNIGHT

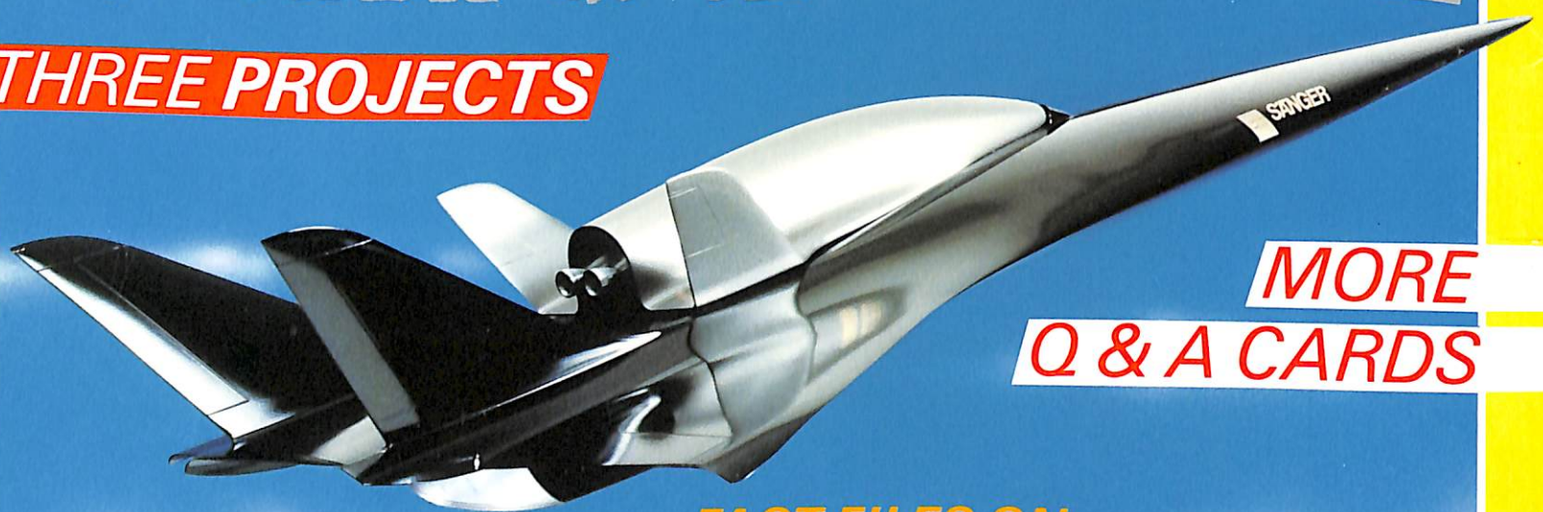
# QUEST

## ADVENTURES IN THE WORLD OF SCIENCE

# TRANSPORT

12

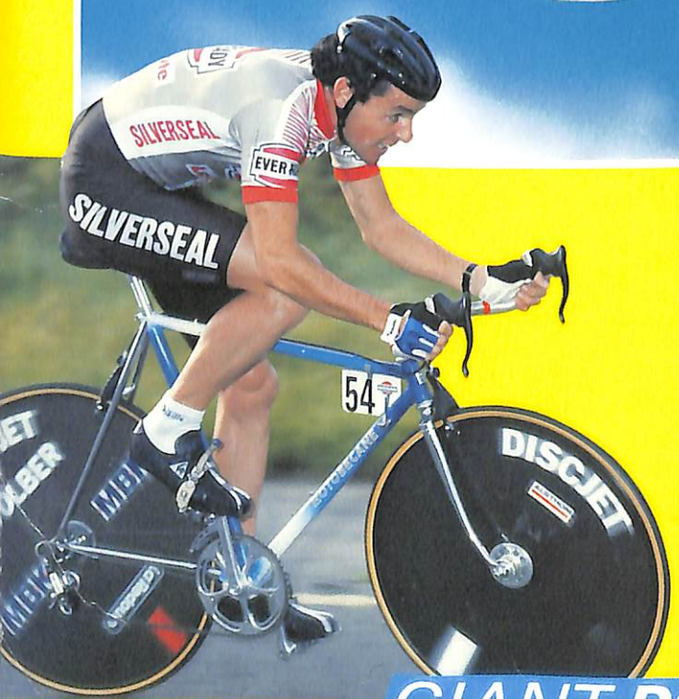
THREE PROJECTS

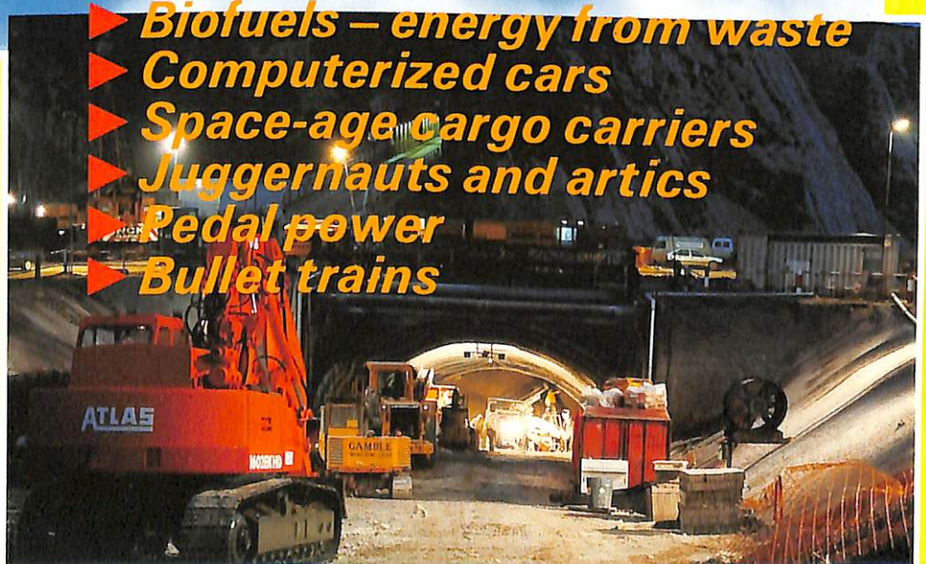



MORE Q & A CARDS

FACT FILES ON

- Hypersonic airliners
- Biofuels – energy from waste
- Computerized cars
- Space-age cargo carriers
- Juggernauts and artics
- Pedal power
- Bullet trains




GIANT POSTER: CHANNEL TUNNEL

UK £1.99 IR£2.25 Aust $4.95 NZ $5.95 (inc. GST) Malaysia $7.95 Sing $5.95 Malta Lm1.75

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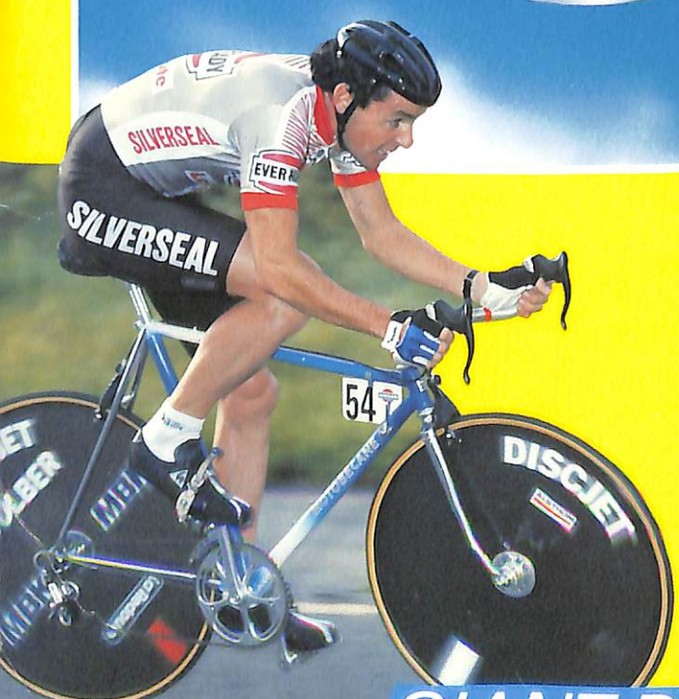


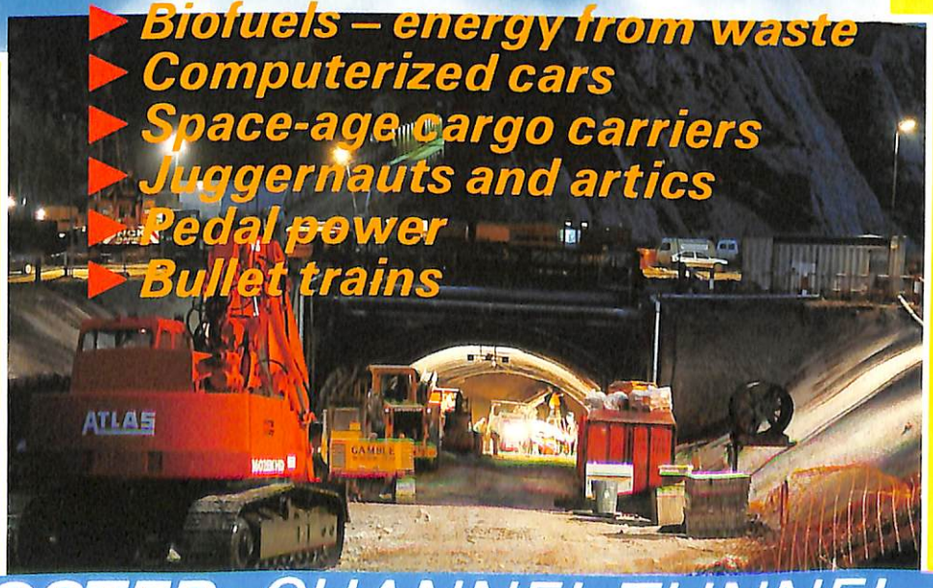


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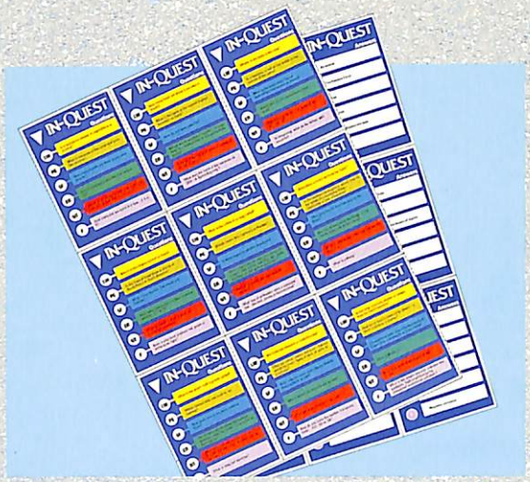
# INSIDE THIS PACK

## FACT FILES

▶ Autoguide systems ▶ Bullet trains ▶ Methane from manure ▶ Semi-submersible ships ▶ The container revolution ▶ Computerized gears ▶ Horse power ▶ Hypersonic airliners




In-Quest question and answer cards

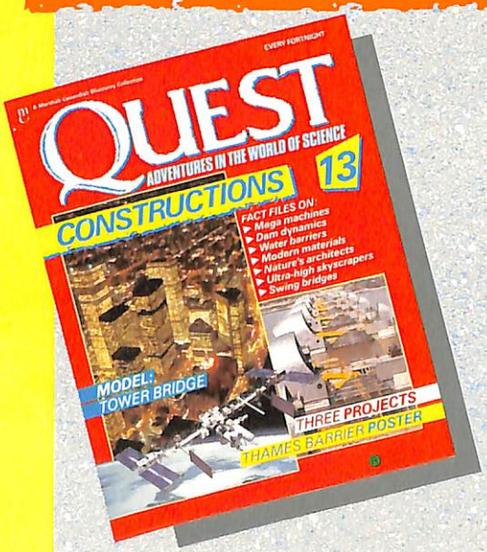

## POSTER

Channel Tunnel


## PROJECT SHEET

- Rocket-powered boat
- Road traffic survey
- How wheels work

# COMING IN QUEST 13 CONSTRUCTION

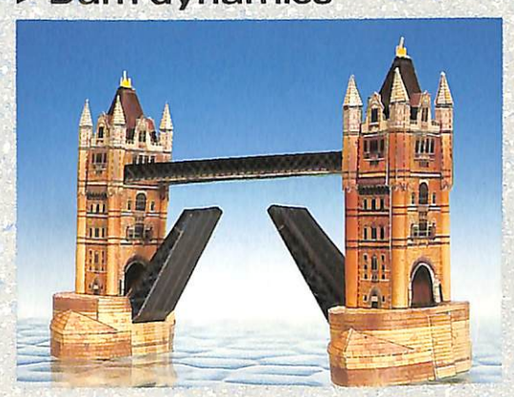



## FACT FILES INCLUDE

▶ Building in space
▶ Modern materials
▶ Swing bridges
▶ Underground cities
▶ How safe are skyscrapers?
▶ Dam dynamics

## POSTER

The Thames barrier



## MODEL

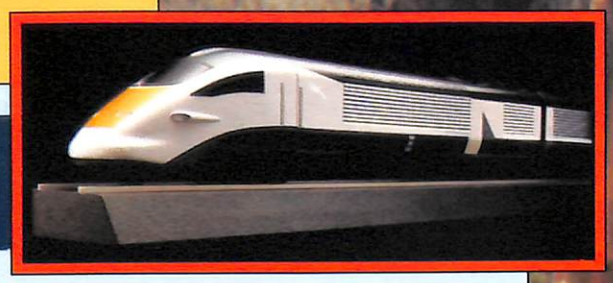
Tower Bridge

ISSN 1350-3766
12
9 771350 376022


Photographs: train, courtesy of Jones Garrard Ltd. All other pictures courtesy of The Channel Tunnel Group Ltd.

QUEST

# PROFILE



## THE CHANNEL TUNNEL

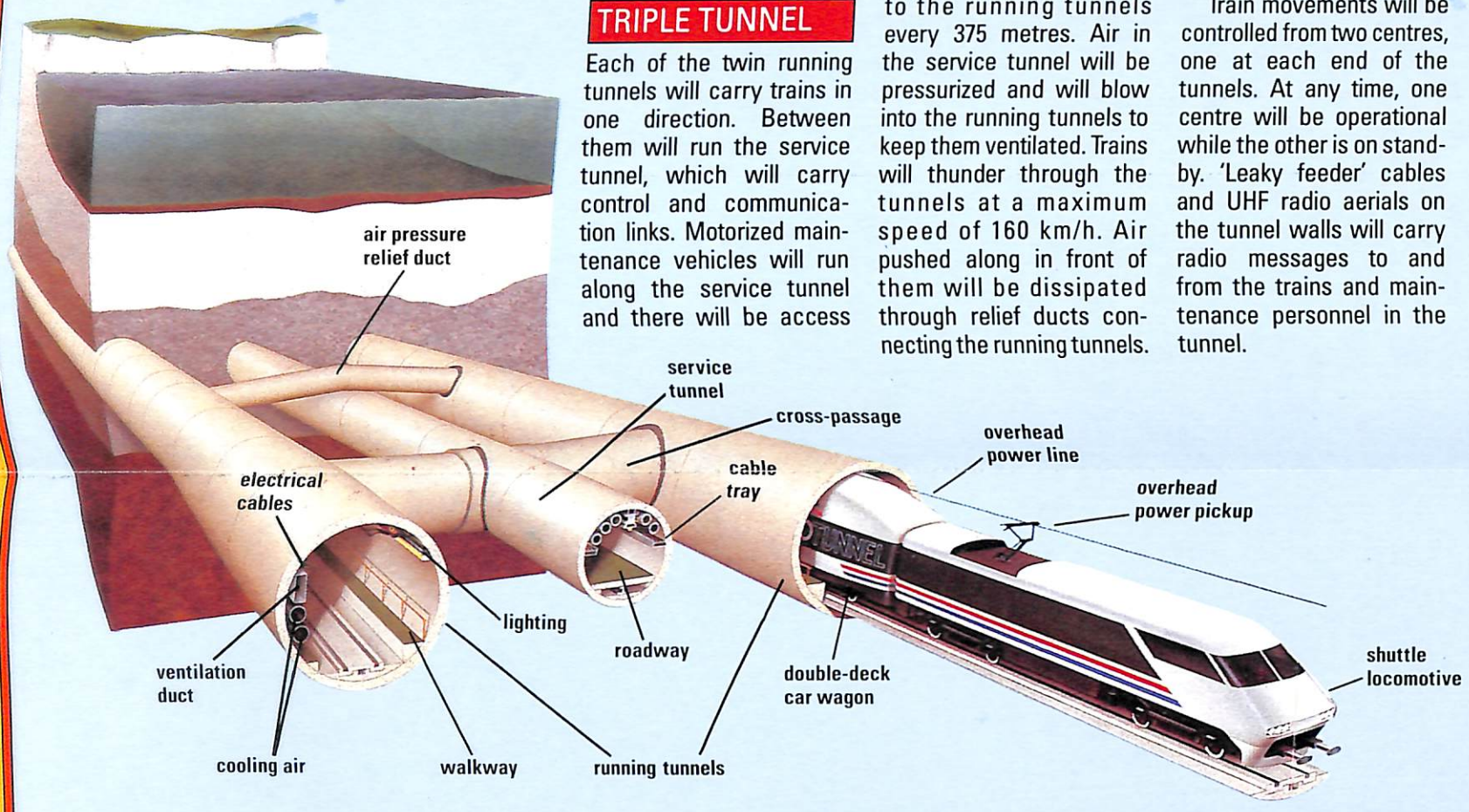
When the Channel Tunnel begins operations in 1994, it will slash the rail journey time between London and Paris to three hours – half the time that it now takes by rail and hovercraft. Possibly 15 million passengers on through trains could use the tunnel in the first year. A roughly equal number of car travellers will be whisked through the tunnel, still on board their vehicles, on special car-carrying shuttle trains. Vehicles will be able to arrive at a terminal and get a place on a shuttle without booking in advance. At peak times trains will be entering each of the twin running tunnels every three minutes, on a subterranean journey in which they will touch speeds of 160 km/h.

**Length:** 49.4 km – 38 km lie beneath seabed, on average 25–40 m deep.
**Dimensions:** twin running tunnels each 7.6 m diameter; central service tunnel 4.8 m diameter.
**Connecting tunnels:** every 375 m.
**Earth excavated from tunnels:** 7.5 million cubic metres.
**Construction time:** approx 7 years.
**Completion date:** 1994
**Cost:** approx. £3.5 billion.
**Train frequencies:** (per hour in each direction at peak times, initially) 5-6 passenger shuttles; 4 freight shuttles; 4 passenger through trains; 2 freight through trains.
**Journey times:** 35 minutes between terminals near Folkestone and Calais.

## TRIPLE TUNNEL

Each of the twin running tunnels will carry trains in one direction. Between them will run the service tunnel, which will carry control and communication links. Motorized maintenance vehicles will run along the service tunnel and there will be access to the running tunnels every 375 metres. Air in the service tunnel will be pressurized and will blow into the running tunnels to keep them ventilated. Trains will thunder through the tunnels at a maximum speed of 160 km/h. Air pushed along in front of them will be dissipated through relief ducts connecting the running tunnels.

Train movements will be controlled from two centres, one at each end of the tunnels. At any time, one centre will be operational while the other is on standby. 'Leaky feeder' cables and UHF radio aerials on the tunnel walls will carry radio messages to and from the trains and maintenance personnel in the tunnel.

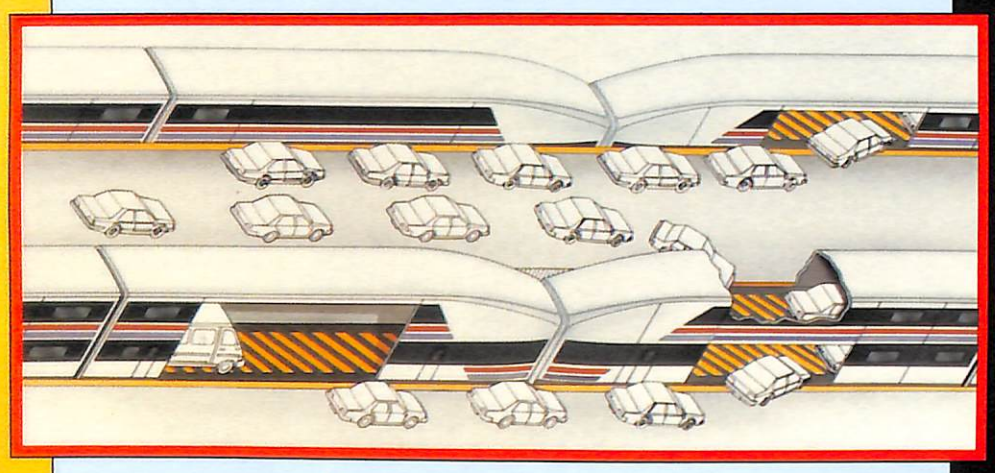



## WAGON TRAINS

Cars will travel under the Channel in trains made up of double-deck and single-deck wagons. They will drive on at the terminals near Folkestone and Calais, having already been through customs and immigration checks. Each train will be made up of two 'rakes' (or sets) of wagons. Vehicles will drive on via a special loading wagon at the rear of each rake. Caravans, buses and other vehicles of above-average height will go into single-deck wagons.

At peak times, one of these 'shuttle' passenger trains will depart every 12-15 minutes. Each will carry 200 or more cars. Travellers will stay with their vehicles, perhaps just getting out to use vending machines or toilets in the wagon. After the 35-minute trip from one terminal to the other, they will drive off the train through the unloading wagons and proceed straight to the motorway.

Trucks will be carried in trains consisting of 25 single-deck wagons. One wagon will accommodate one large truck. One of these freight shuttles will depart every 15 minutes at peak times.



## EXCAVATION

During the excavation, small locomotives pulled wagons carrying men and equipment to the workforce. On their return journey, they carried the 'spoil' – excavated soil – to a conveyor belt which took it to the surface.

# SPORT TO EUROPE


Photographs: train, courtesy of Jones Garrard Ltd. All other pictures courtesy of The Channel Tunnel Group Ltd.

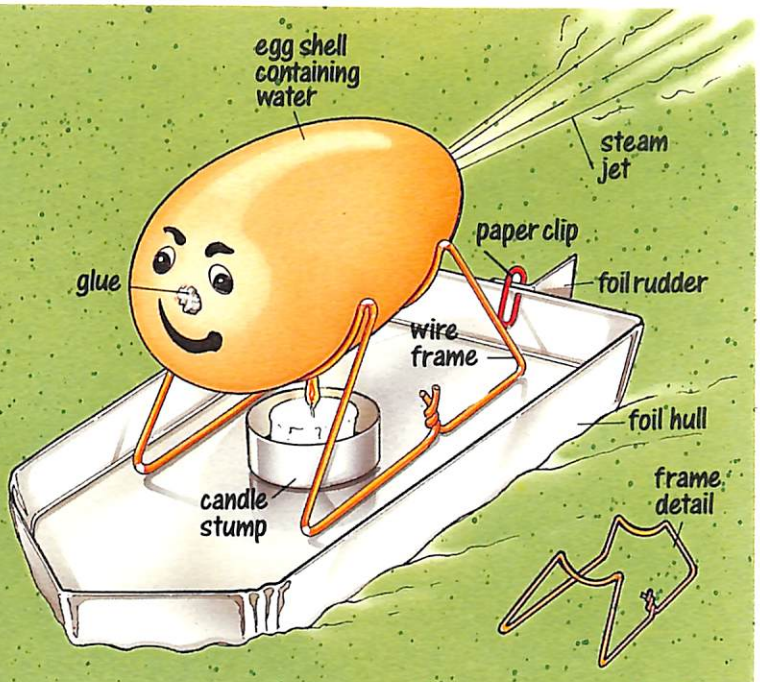
## BUILDING THE CHANNEL TUNNEL

QUEST

# PROJECTS

## TRANSPORT

- How can you make a rocket-powered boat with an eggshell as the engine?
- How does the rush hour affect the speed of traffic in your area?
- Why is a bicycle easier to balance when it is moving?




## A ROCKET BOAT

1 2 3 4 5

**Use a candle flame to boil water in an eggshell. The jet of steam produced will provide enough thrust to propel a small model boat.**

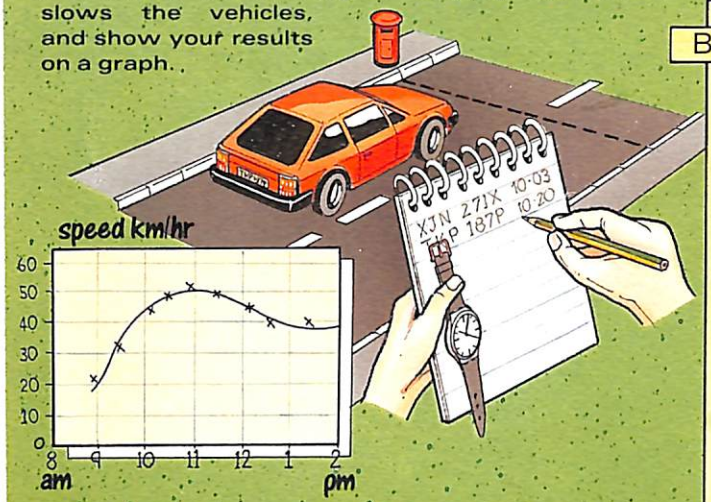
Wash the outside of an uncracked raw chicken's egg and pierce a tiny hole through it, from end to end, using a thin skewer or some stiff wire. Hold the egg over a basin and blow through one of the holes. The yolk and white of the egg will come out of the hole at the other end of the shell and fall into the basin. Hold the eggshell under water and remove it when it is about half full. Put your fingers over the holes and shake it to clean the inside. Blow out the contents, then rinse the eggshell again in the same way. Now dry the outside of the shell and seal one of the holes with a blob of thick glue. Leave the glue to set.

Make the boat from a rectangular metal foil food container – the type that some take-away meals come in. Trim the sides with scissors and bend one end to form the boat's curved bow. Clip a small flap of scrap foil to the stern of the boat to act as a simple rudder. Bend a piece of stiff wire to form a holder for the eggshell; cut a small piece from the top of a candle. Hold the shell under water so that a little water enters. Don't let too much in as it will take a long time to boil. Using hand-hot water will speed things up too. Arrange the candle stump, wire frame and shell as shown and light the candle. After a few minutes, the boat will move forward, propelled by a jet of steam.

## ROAD TRAFFIC SURVEY

1 2 3 4 5

**Carry out a road traffic survey to find out how much the morning or evening rush hour slows the vehicles, and show your results on a graph.**




This project is easiest to carry out if you and a friend live at least 1 km apart on a main road, with a clear view of the traffic. With the aid of a local map, find out the distance between your homes. Select a particular make or model of car on which to base this survey so that you do not have to make notes on every car that passes. From your windows, note the numbers of the selected type of car and the time that each one passes, using accurately set watches with seconds displays. Afterwards, compare notes and calculate the speed of each car in the survey. To do this, multiply the distance between your houses (in km) by 3,600; then divide by the the number of seconds that the car took to travel this distance. The result will be the average speed in km per hour. Finally, draw a graph showing the traffic speeds at various times.

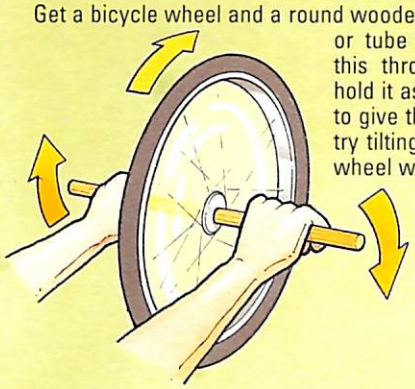
John Houghton

## BICYCLE BALANCE

1 2 3 4 5

**Spinning bicycle wheels act like gyroscopes and resist attempts to make them overbalance.**

Get a bicycle wheel and a round wooden stick or a metal rod or tube to spin it on. Insert this through the wheel and hold it as shown. Ask a friend to give the wheel a spin, then try tilting one side down. The wheel will resist being forced in this direction. Instead, it will tend to turn to the right or left. The tendency of the wheel to resist tilting is called gyroscopic inertia.



### PROJECT INFORMATION

1 2 3 4 5

Each **QUEST** project has its own difficulty rating: 1 very simple, 2 simple, 3 intermediate, 4 advanced, 5 complicated.

**WARNING!**

Parents should supervise experiments involving sharp tools, water and electricity. The publisher can accept no responsibility for injury.

# DATAQUEST

**NOTE** Corrections to DataQuest programs
**Spectrum:** line 1000 should read
1000 PRINT AT 2,1;"OPENING A NEW FILE ERASES ALL": PRINT AT 3,8;"PREVIOUS RECORDS": PRINT AT 7,9;"ARE YOU SURE?": PAUSE U: IF INKEY$="" THEN GOTO 1000
**Commodore 64:** line 70
At the end of the line change the stop before the LL to a comma to read ",LL)

## SPORT: SPEEDS

| km/h | Record | Name | Date |
|---|---|---|---|
| 1,190.38 | Highest land speed (unofficial) | Stan Barrett | 1979 |
| 1,019.47 | Highest land speed (official) | Richard Noble | 1983 |
| 1,006 | Freefall parachute | J. W. Kittinger | 1960 |
| 556 | Highest water speed (unofficial) | Ken Warby | 1977 |
| 514.39 | Highest water speed (official) | Ken Warby | 1978 |
| 513.16 | Motor-cycle | Don Vesco | 1978 |
| 403.88 | Motor racing | Hans Liebold | 1979 |
| 302 | Pelota (fastest ball game) | José Areitio | 1979 |
| 263 | Lawn Tennis | Bill Tilden | 1931 |
| 252 | Le Mans 24 hr | Hans Stuck | 1985 |
| 245 | Cycling | John Howard | 1985 |
| 230 | Water-skiing | Chris Massey | 1983 |

| km/h | Record | Name | Date |
|---|---|---|---|
| 208 | Downhill skiing | Franz Weber | 1984 |
| 195 | Gliding | Ingo Renner | 1982 |
| 190 | Ice hockey puck | Bobby Hull | 1965 |
| 162 | Baseball (pitch) | Lynn Nolan Ryan | 1974 |
| 84 | Speedway | Scott Autrey | 1978 |
| 84 | Tobogganing | Franco Gansser | 1984 |
| 69 | Horse racing | 'Big Racket' | 1945 |
| 67 | Greyhound racing | 'The Shoe' | 1968 |
| 66 | Sailing | Tim Coleman | 1980 |
| 56 | Boxing (speed of punch) | Sugar Ray Robinson | 1957 |
| 41 | Roller skating | Giuseppe Cantarrella | 1963 |
| 40 | Sprinting | Carl Lewis | 1983 |
| 15 | Walking (1 hour) | Ernesto Canto | 1984 |
| 8 | Swimming (50 m) | Robin Leamy | 1981 |

## WEATHER: TEMPERATURE

| Highest | Temp. | Place |
|---|---|---|
| Africa | 58°C | Azizia, Libya |
| USA | 57°C | Death Valley, California |
| Asia | 54°C | Tirat Tsvi, Israel |
| Australia | 53°C | Cloncurry, Queensland |
| Europe | 50°C | Seville, Spain |
| Antarctica | 14°C | Esperanaza, Palmer |

| Lowest | Temp. | Place |
|---|---|---|
| Antarctica | –88°C | Vostok |
| Asia | –68°C | Oimekon, USSR |
| USA | –63°C | Snag, Yukon |
| Europe | –55°C | Ust'Schchugor, USSR |
| Africa | –24°C | Ilfrane, Morocco |
| Australia | –22°C | Charlotte Pass, NSW |

## AVERAGE ANNUAL RAINFALL (mm)

| Highest | Amount | Place |
|---|---|---|
| Oceania | 11,684 | Mt Wai'ale'ale, Hawaii |
| Asia | 11,430 | Cherrapunji, India |
| Africa | 10,277 | Debundseha, Cameroon |
| S. Amenca | 8,991 | Quibdo, Colombia |
| N. America | 6,655 | Henderson Lake, Canada |

| Lowest | Amount | Place |
|---|---|---|
| S. America | 0.8 | Arica, Chile |
| Africa | 2.5 | Wadi Halfa, Sudan |
| N. America | 30.5 | Bataques, Mexico |
| Asia | 45.7 | Aden, South Yemen |
| Australia | 119.3 | Millers Creek |
| Europe | 162.5 | Astrakhan, USSR |

## TRANSPORT: AIRLINES OF THE WORLD

| Airline | Passengers carried | Aircraft departures |
|---|---|---|
| Aeroflot, USSR | 109,483,800 | 52,600 |
| United Airlines, USA | 38,267,100 | 458,100 |
| Eastern Airlines, USA | 37,431,100 | 514,900 |
| Delta Airlines, USA | 36,947,700 | 509,700 |
| American Airlines, USA | 28,842,700 | 326,000 |
| ANA, Japan | 22,136,400 | 168,900 |
| TWA, USA | 18,640,200 | 195,200 |
| Republic Airlines, USA | 17,898,700 | 452,200 |
| US Airlines, USA | 16,630,200 | 316,200 |
| Pan-Am, USA | 15,199,700 | 144,300 |
| British Airways, UK | 14,259,500 | 167,100 |
| JAL, Japan | 13,717,600 | 76,100 |
| Western Airlines, USA | 13,388,900 | 163,000 |
| Lufthansa, Germany | 13,134,500 | 195,700 |
| Northwest Airlines, USA | 12,904,200 | 168,300 |
| Iberia, Spain | 12,866,500 | 160,300 |
| Air France, France | 11,715,500 | 133,300 |
| Saudi Airlines, Saudi Arabia | 10,936,600 | 108,800 |
| Air Canada, Canada | 10,502,600 | 164,300 |
| Continental Airlines, USA | 10,353,500 | 168,800 |

| Airline | Passengers carried | Aircraft departures |
|---|---|---|
| Alitalia, Italy | 7,410,100 | 85,100 |
| Frontier Airlines, USA | 6,457,600 | 138,900 |
| Swissair, Switzerland | 6,105,500 | 89,800 |
| Malaysian Air Services, Malaysia | 4,904,600 | 87,800 |
| KLM, Netherlands | 4,582,500 | 65,600 |
| Singapore Int. Airlines, Singapore | 4,545,300 | 34,700 |
| SAA, South Africa | 3,851,900 | 56,400 |
| Varig International, Brazil | 3,751,600 | 61,900 |
| CP Air, Canada | 3,694,200 | 47,700 |
| Korean Airlines, Korea | 3,612,500 | 31,300 |
| Cathay Pacific Airlines, Hong Kong | 3,238,700 | 19,700 |
| Air New Zealand | 3,102,100 | 68,200 |
| Pakistan Int. Airlines, Pakistan | 2,571,700 | 33,000 |
| Thai Int. Airlines, Thailand | 2,208,500 | 17,200 |
| Quantas Airways, Australia | 2,095,000 | 17,000 |